

CLAIM LISTING

1. (previously presented): An apparatus for modifying an electrical audio signal for input to a sonic reproduction device that includes a speaker characterized by a plurality of individual responses which in combination define an overall response for the sonic reproduction device which includes frequency, time, phase and transient response, said apparatus comprising:

a plurality of modification filters having modification responses that simulate the plurality of individual responses, at least one said modification filter simulating an individual component of the speaker, the modification filters for receiving the electrical audio signal, modifying the electrical audio signal and providing the electrical audio signal to the sonic reproduction device; and

a plurality of adjustable parameters, each associated with at least one of the modification filters for allowing adjustments to the responses of the modification filters;

wherein the adjustments create a plurality of individual conjugate responses, each individual conjugate response associated with at least one of the plurality of individual responses.

2. (original): The apparatus of claim 1 wherein the plurality of individual responses of the sonic reproduction device are related to at least one of

1 mechanical, acoustic and electromagnetic behavior of the sonic reproduction
2 device.

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4 3. (original): The apparatus of claim 1 wherein the filters are defined by
5 digital signal processes.

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7 4. (original): The apparatus of claim 1 wherein the filters are defined by
8 analog circuitry.

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10 5. (original): The apparatus of claim 1 wherein the plurality of
11 modification filters are non-interacting.

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13 6. (original): The apparatus of claim 1 wherein the plurality of
14 modification responses combine to form an overall response that is a conjugate to
15 the overall response for the sonic reproduction device.

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17 7. (original): The apparatus of claim 1 wherein at least one of the
18 modification filters comprises a cut-off filter and the parameters for adjusting the
19 frequency response of the cut-off filter comprise peak frequency, amplitude and Q
20 parameters.
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1 8. (original): The apparatus of claim 7 wherein the peak frequency,
2 amplitude and Q parameters modify the frequency response of the cut-off filter in
3 at least one of the low and high frequency ranges.

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5 9. (original): The apparatus of claim 1 wherein at least one of the
6 modification filters comprises a constant slope equalizer and the parameters for
7 adjusting the frequency response of the constant slope equalizer comprise
8 crossover frequency and boost shelf parameters.

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11 10.(original): The apparatus of claim 9 wherein the crossover frequency
12 and boost shelf parameters modify the frequency response of the constant slope
13 equalizer in at least one of the low and high frequency ranges.

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15 11.(original): The apparatus of claim 1 wherein at least one of the
16 modification filters comprises a parametric notch filter and the parameters for
17 adjusting the frequency response of the parametric notch filter comprise notch
18 frequency, amplitude and Q parameters.

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21 12.(original): The apparatus of claim 1 wherein at least one of the
22 modification filters comprises a parametric notch-boost filter and the parameters
23 for adjusting the frequency response of the parametric notch-boost filter comprise
24 notch frequency, amplitude and Q parameters.
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2 13.(previously presented): A sound compensation system for altering an
3 electrical audio signal for input to a sonic reproduction device including a speaker
4 and an enclosure which have associated behavioral characteristics, said system
5 comprising:

6 a model of the sonic reproduction device having a plurality of filters that
7 simulate at least one of the behavioral characteristics of the sonic reproduction
8 device, each filter having an associated response that combine to define an overall
9 response for the model, at least one said filter simulating an individual component
10 of the speaker and another said filter simulating the enclosure, each response
11 comprising at least one of a frequency, time, phase or transient response; and
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13 a controller that modifies the response of each of the plurality of filters to
14 transform the filter into a conjugate filter having a responses that is conjugate to
15 the original response of the filter.
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18 14.(original): The system of claim 13 wherein the behavior characteristics
19 are defined by individual components of the sonic reproduction device.
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21 15.(original): The system of claim 13 wherein the behavioral characteristics
22 are defined by groups of individual components of the sonic reproduction device.
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1 16.(original): The system of claim 13 wherein the filters are defined by
2 digital signal processes and the controller comprises a computer.

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4 17.(original): The system of claim 13 wherein the filters are defined by
5 analog circuits and the controller comprises adjustable circuit components.

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7 18.(original): The system of claim 13 wherein the sonic reproduction
8 device comprises a speaker and at least one of the plurality of filters comprises at
9 least one associated adjustable parameter and the value of the parameter is
10 calculated based on physical characteristics of the speaker.
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13 19.(previously presented): The system of claim 18 wherein the physical
14 characteristics of the speaker comprises at least one of cone and coil mass, air
15 volume, mechanical compliance, radiating area, damping, moving mass and motor
16 characteristics.
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19 20.(original): The system of claim 13 wherein the sonic reproduction
20 device comprises a speaker and at least one of the plurality of filters comprises at
21 least one associated adjustable parameter and the value of the parameter is derived
22 from a standard speaker model.
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1 21.(original): The system of claim 13 wherein at least one of the plurality
2 of filters has at least one associated adjustable parameter and the value of the
3 parameter is determined experimentally using standard test measurements.

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5 22.(original): The system of claim 13 wherein the controller is configured
6 such that an adjustment in the setting of at least one other parameter.

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8 23.(original): The system of claim 22 wherein the sonic reproduction
9 device comprises a speaker and the one parameter that modulates the at least one
10 other parameter relates to the magnet structure and voice coil of the speaker.

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13 24.(original): The system of claim 13 wherein the controller monitors the
14 program conditions at the sonic reproduction device and sets at least one of the
15 parameter values based on the program conditions.

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18 25.(original): The system of claim 24 wherein the program conditions
19 comprise at least one of volume control settings, program level and bass content.

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21 26.(original): The system of claim 13 wherein one of the filters comprises a
22 weighted compensation notch filter.
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1 27.(original): The system of claim 26 wherein the filter comprises a single-
2 tuned weighted compensation notch.

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4 28.(original): The system of claim 26 wherein the filter comprises a
5 double-tuned weighted compensation notch.

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7 29.(previously presented): A sound system comprising:

8 a sonic reproduction device having associated mechanical, acoustic and
9 electromagnetic behavioral characteristics;

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11 a source for outputting an electrical audio signal to a model of the sonic
12 reproduction device, the model having a plurality of filters that simulate at least
13 one of the mechanical, acoustic and electromagnetic behavioral characteristics of
14 the sonic reproduction device, at least one said filter simulating an individual
15 component of a speaker of the sonic reproduction device, the plurality of filters
16 providing an overall response of the sonic reproduction device that includes
17 frequency, time, phase or transient response, the model outputting the electrical
18 audio signal to the sonic reproduction device; and

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20 a controller that modifies the responses of the filters to transform the model
21 into a conjugate model having a plurality of filters with responses that comprise
22 conjugates to the original response of the filter.
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1 30. (original): The system of claim 29 wherein the filters are defined by
2 digital signal processes.

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4 31. (original): The system of claim 29 wherein the filters are defined by
5 analog circuitry.

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7 32. (original): The system of claim 29 wherein the plurality of filters are
8 non-interacting.

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11 33. (original): The system of claim 29 wherein at least one of the filters
12 comprises a cut-off filter and modifications to the frequency response of the cut-
13 off filter comprise adjustments to peak frequency, amplitude and Q.

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15 34. (original): The system of claim 29 wherein at least one of the filters
16 comprises a constant slope equalizer and modifications of the frequency response
17 of the constant slop equalizer comprise adjustments to crossover frequency and
18 boost shelf.

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21 35. (original): The system of claim 29 wherein at least one of the filters
22 comprises a parametric notch filter and modifications to the frequency response of
23 the parametric notch filter comprise adjustments to notch frequency, amplitude
24 and Q.
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2 36.(original): The system of claim 29 wherein at least one of the filters
3 comprises a parametric notch-boost filter and modifications to the frequency
4 response of the parametric notch-boost filter comprise adjustments to notch
5 frequency, amplitude and Q.
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8 37.(previously presented): A method for modifying an electrical audio
9 signal for input to a sonic reproduction device having a speaker and an enclosure
10 which are characterized by a plurality of individual responses which in
11 combination define an overall response for the sonic reproduction device that
12 includes frequency, time, phase and transient response, said method comprising
13 the steps of:
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15 simulating the plurality of individual responses with a plurality of filters,
16 wherein at least one said filter simulates an individual component of the speaker
17 and another said filter simulates the enclosure;

18 adjusting the responses of the plurality of filters such that, for each filter,
19 the adjusted response comprises a response that is a conjugate to one of the
20 individual responses; and

21 inputting the electrical audio signal to the filters.
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24 38.(original): The method of claim 37 wherein the plurality of individual
25 responses of the sonic reproduction device are related to at least one of a

1 mechanical, acoustic and electromagnetic behavior of the sonic reproduction
2 device.

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4 39.(original): The method of claim 37 wherein the plurality of filters are
5 non-interacting.

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7 40.(original): The method of claim 37 wherein the plurality of adjusted
8 responses combine to form an overall response that is a conjugate to the overall
9 response for the sonic reproduction device.
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12 41.(original): The method of claim 37 wherein at least one of the filters
13 comprises a cut-off filter and the step of adjusting the frequency response of the
14 cut-off filter comprises the step of setting at least one of peak, frequency,
15 amplitude and Q.
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18 42.(original): The method of claim 37 wherein at least one of the filters
19 comprises a constant slope equalizer and the step of adjusting the frequency
20 response of the constant slope equalizer comprises the step of setting at least one
21 of crossover frequency and boost shelf.
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24 43.(original): The method of claim 37 wherein at least one of the filters
25 comprises a parametric notch filter and the step of adjusting the frequency

1 response of the parametric notch filter comprises the step of setting at least one of
2 notch frequency, amplitude and Q.

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4 44.(original): The method of claim 37 wherein at least one of the filters
5 comprises a parametric notch-boost filter and the step of adjusting the frequency
6 response of the parametric notch-boost filter comprises the step of setting at least
7 one of notch frequency, amplitude and Q.

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10 Claims 45-54 (cancelled).

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12 55. (previously presented): A sound compensation system for altering an
13 electrical audio signal for input to a sonic reproduction device having associated
14 behavioral characteristics, said system comprising a model of the sonic
15 reproduction device having a plurality of filters that simulate behavioral
16 characteristics of the sonic reproduction device, wherein:
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18 each said filter has an associated response that is combinable to define an
19 overall response for the model; and

20 at least one said filter, which corresponds to an individual component of the
21 sonic reproduction device, is replaceable with another filter in response to
22 replacement of the individual component of the sonic reproduction device with
23 another individual component, wherein the other filter simulates a behavioral
24 characteristic of the other individual component.
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2 56.(previously presented): The system of claim 55 wherein the individual
3 component corresponds to an individual component of a speaker.
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5 57.(previously presented): The system of claim 55 wherein the behavioral
6 characteristics are defined by groups of individual components of the sonic
7 reproduction device.
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10 58.(previously presented): The system of claim 55 wherein one or more
11 said filters correspond to an enclosure of the sonic reproduction device.
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13 59.(previously presented): The system of claim 55 wherein the sonic
14 reproduction device comprises a speaker and at least one of the plurality of filters
15 comprises at least one associated adjustable parameter and the value of the
16 parameter is calculated based on physical characteristics of the speaker.
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19 60.(previously presented): The system of claim 60 wherein the physical
20 characteristics of the speaker comprises at least one of cone and coil mass, air
21 volume, mechanical compliance, radiating area, damping, moving mass and motor
22 characteristics.
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1 61.(previously presented): The system of claim 55 wherein the sonic
2 reproduction device comprises a speaker and at least one of the plurality of filters
3 comprises at least one associated adjustable parameter and the value of the
4 parameter is derived from a standard speaker model.
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6 62.(previously presented): The system of claim 55 wherein at least one of
7 the plurality of filters has at least one associated adjustable parameter and the
8 value of the parameter is determined experimentally using standard test
9 measurements.
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12 63.(previously presented): The system of claim 55 wherein the sonic
13 reproduction device comprises a speaker and the one parameter that modules the at
14 least one other parameter relates to the magnet structure and voice coil of the
15 speaker.
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